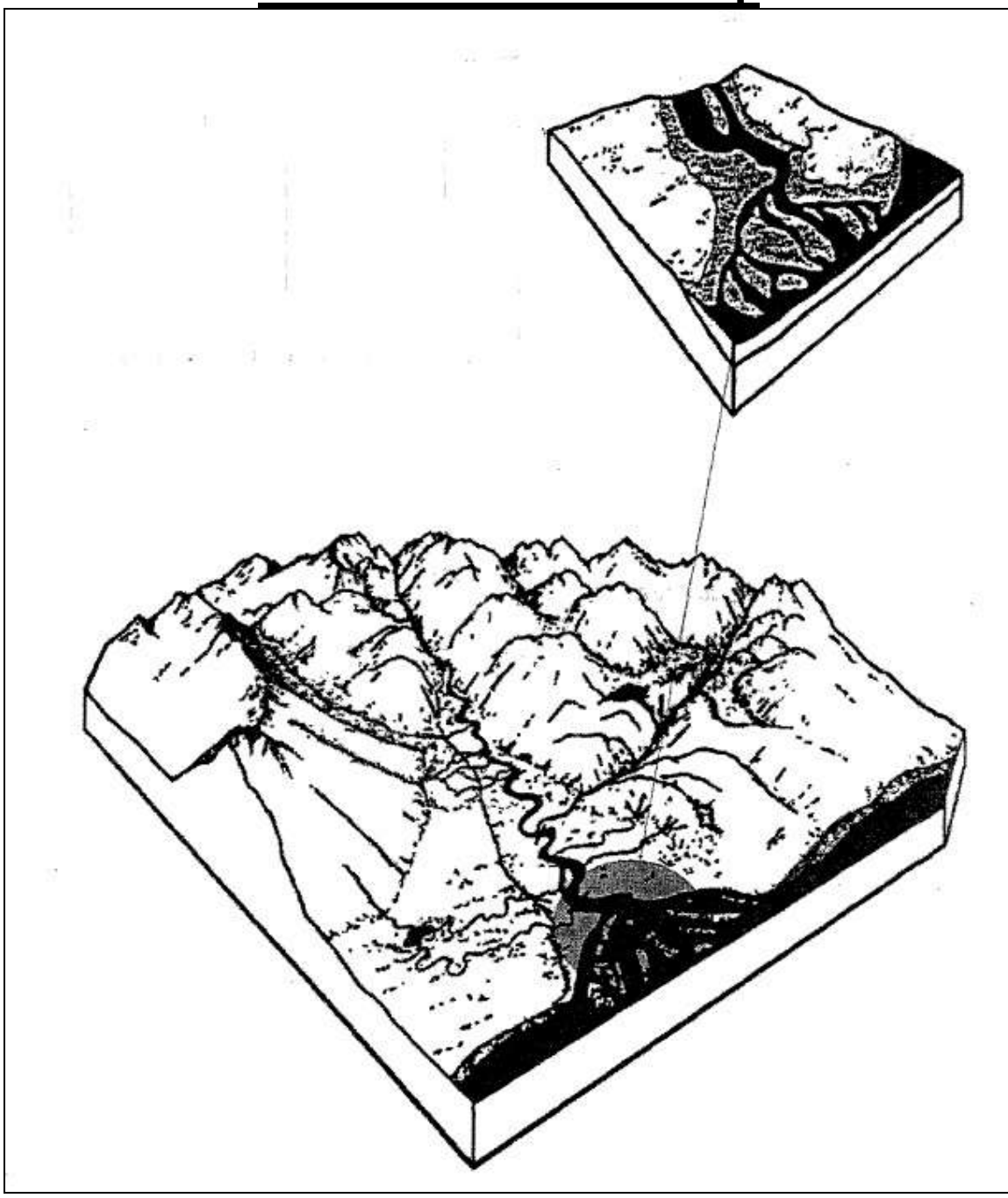


Estuarine Process Group





The estuarine process group includes intertidal streams that are directly influenced by tidal inundation. Stream stage fluctuation, channel morphology, sediment transport, and water chemistry are influenced to some degree by saltwater inundation in estuary stream segments. Estuarine saltwater marshes, meadows, mudflats and gravel deltas are depositional environments associated with estuarine channels. The riparian area encompasses the entire estuarine wetland system.

Channel type	Label	Former label
Micro Estuarine channel	ESO	
Small Estuarine Channel	ESS	ES1, ES2, ES3
Medium Estuarine Channel	ESM	
Large Estuarine Channel	ESL	ES4

Channel type Phases distinguish substrate material:

- f = fine substrate
- g = gravel substrate
- c= cobble to boulder substrate
- d = sand dune association

ESSf formerly labeled an ES1, ESSg formerly labeled an ES2, ESSc formerly labeled an ES3.

ESO - Micro Estuarine Channel

Stream Class:	I or II
Stream Gradient:	< 1 %
Incision Depth:	< 1 m
Bankfull Width:	0.3 to 2 m
Bankfull Depth:	0.5m or less
Width/Depth Ratio:	no data
Dominant Substrate:	Silt to coarse gravel.
Stream Bank Composition:	Silt Sand to coarse gravel.
Sideslope Length/Angle:	not significant
Associated Landform:	53, 61, 62
Riparian Vegetation:	salt water tolerant grasses, non-forest
Fish Habitat:	anadromous spawning habitat

These micro channels are commonly tributaries to the larger estuarine channels. They provide connection between the main estuary channel and micro-channels draining the adjacent mountain or valley side slopes.

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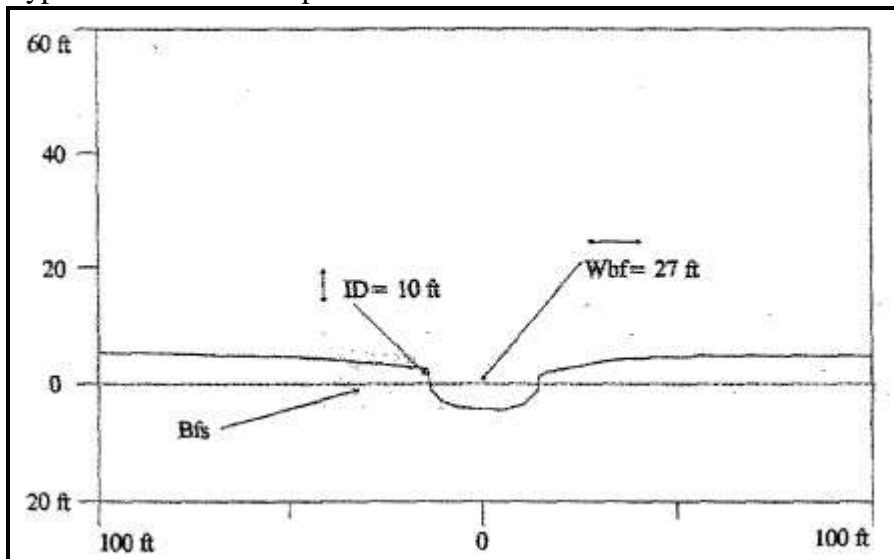
ESS- Small Estuarine Channel



Geographic setting: ESS channels occur exclusively within estuary landforms, usually draining small to moderate sized watersheds, that are found along the outer coastal areas.

Formerly labeled:
ES1, ES2 and ES3.

Typical Cross- section profile.



Channel structure:

Stream Class:	I or II
Stream gradient:	$\leq 1\%$
Bankfull width:	1.5 to 9.9 m
Incision depth:	< 3 m
Stream bank composition:	sand to gravel
Dominant substrate:	silt, sand, gravel
Sideslope length and angle:	not significant features
Channel pattern:	single, sinuous
Drainage basin size:	1-2 mi ² , usually < 5 mi ² .

Plant Association Series	% Cover
Non-forest	48
Western Hemlock	15
W.Hemlock-Red Cedar	13
Sitka Spruce	12

Riparian Vegetation: The riparian plant community is dominated by non-forested plant communities. The Western Hemlock/blueberry plant associations are also significant, Non-forested plant communities consist of estuarine forbs and grasses.

ESS channel Type Phases:

- ❖ ESSf – Fine Substrate Phase
- ❖ ESSg – Gravel Substrate Phase
- ❖ ESSc - Cobble Substrate Phase
- ❖ ESSd - Sand Dune Phase, incised beach or sand dune channels found in coastal foreland areas.

Estuarine channels can be differentiated at the tertiary level by substrate composition. Small steep coastal watersheds may produce larger substrate estuarine channels.



Example of a ESSg.

Management Considerations

Hydrologic Function: ESS streams are predominantly depositional channels. Stream energy is very low. Substrate material consists of silt, gavel and sand. Bank erosion is influenced more by ocean erosion processes than by stream discharge events.

Aquatic Habitat Capability:

Large wood	< 500 ft ³ /1000 linear ft
Available Spawning area (ASA)	Insufficient data
Available Rearing area (ARA)	Insufficient data

Management Indicator Species Ratings														
CT	Coho		Pink		Chum		Sockeye		Chinook		Dolly Varden		Steelhead	
	ASA	ARA	ASA	ARA	ASA	ARA	ASA	ARA	ASA	ARA	ASA	ARA	ASA	ARA
ESSf	N	H	N	N	N	L	N	L	N	N	N	N	N	N
ESSg	H	H	H	H	H	L	N	N	N	N	M	M	N	N
ESSc	M	L	L	L	L	L	N	N	N	N	M	M	N	N

H= High, L = Low, N= Negligible.

These channels are accessible to anadromous species. Spawning area is high and is limited by fine sediment content. Pink and chum salmon frequently, and Dolly Varden char occasionally, spawn in ESS channels. Juvenile coho salmon and Dolly Varden char will move into ESS channels from upstream reaches during summer and will rear until fall. Pink and chum salmon fry may also temporarily inhabit the ESS channel before migrating seaward. Over-wintering habitat is minimal (mean pool depth is 0.02 meters, 0.6 ft).

Riparian Management: The ESS channel type is associated with low relief coastal landforms, therefore, sediment retention is rated high. Stream banks are composed of sand and fine gravel, therefore highly sensitive to erosion.

Beach erosion processes often have a dominant influence on these outer coastal estuarine streams. Stream channel protection (BMP 13.16), construction in riparian areas (BMP 14.14), and bridge/culvert design (BMP 14.17) should be emphasized.

Management concern for:	ESSf/g	ESSc
Large wood	Low	Low
Sediment retention	High	Moderate
Stream bank stability	High	Moderate
Sideslope sensitivity	N/A	N/A
Flood plain protection need	Moderate	Moderate
Culvert fish passage	Moderate	High

Culvert installations in the upland segments of ESS channels should be designed to provide unrestricted passage for juvenile salmonids (BMP 14.17)

Stream Class: These are classified as Stream **Class I** streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber

Reform Act, 1991). Control of in-channel operations is an important riparian management concern for these streams (BMP 14.14).

ESSc concerns:

Sediment retention in the large substrate **ESSc** channel is moderate. These channels are found on estuaries often downstream of streams making a rapid transition from high energy mountainslopes to the lower gradient estuary. Fine sediments are readily flushed from the ESSc during flood or storm events. Stream banks are composed of coarse gravel or cobble size alluvium, therefore only moderately susceptible to stream bank erosion. Fish habitat is limited due to higher energy streamflows and beach erosion rates. It is important to consider upstream anadromous fish migration in these channels (BMP 14.4, 14.17).

ESM – Moderate Width Estuarine Channel



Channel characteristics

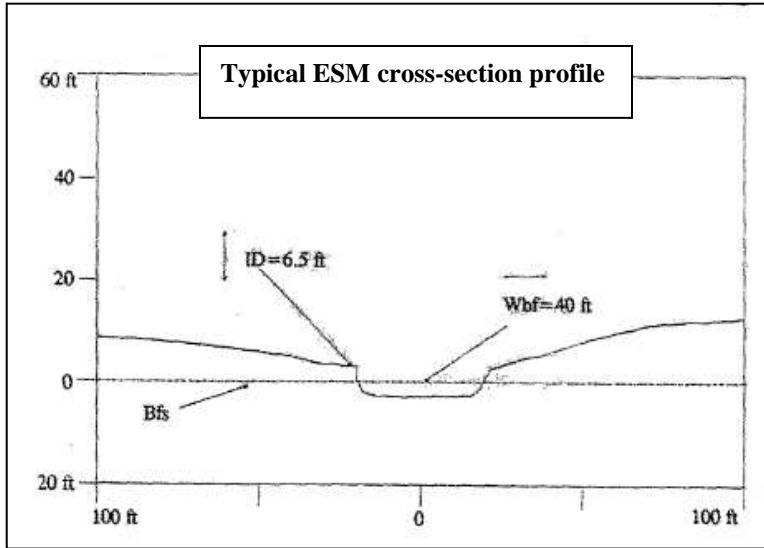
Stream Class:	I or II
Bankfull width:	10 to 20m
Incision depth:	< 2m (6.5 ft)
Dominant substrate:	Gravel, also silt, sand and cobbles
Stream bank composition:	alluvium
Sideslope length and angle:	not significant
Channel pattern:	single to multiple, normally single at the apex of the delta, with channel branching at the seaward terminus
Drainage basin area:	12 – 40 km ² (5-15 mi ²)

Riparian Vegetation: The ESM non-forest riparian plant communities are dominated by grass and sedge communities. The Sitka Spruce series and the Western Hemlock series are also significant beach fringe communities.

Plant Association Series	% Cover
Non-forest	59
Sitka Spruce	23
Western Hemlock	14

ESM Phases

- ❖ ESMf – Fine Substrate Phase
- ❖ ESMg – Gravel Substrate Phase
- ❖ ESMc - Cobble Substrate Phase
- ❖ ESMd - Sand Dune Phase, incised beach or sand dune channels found in coastal foreland areas.



Wbf-bankfull width = 12m
(40 ft)

Management Considerations

Hydrologic function: ESMs are depositional channels subject to tidal influences. Stream energy is low due to width and low gradient. Gravel and sand bars tend to be stable bed features, except during extreme flow events. Large wood can significantly influence channel structure as pool forming features.

Aquatic Habitat Capability:

These channels are always accessible to anadromous species. Generally, gravel substrate provides spawning area. Spawning pink and chum salmon will frequent ESM channels in high densities. Although pool development is minimal, rearing coho salmon will move downstream from the mainstem in the summer to rear here. Pink and chum salmon fry may temporarily remain in the ESM system prior to moving seaward.

Indicator Species Ratings		
MIS	ASA	ARA
Coho	High	Low
Pink	High	High
Chum	High	High
Sockeye	Negligible	Negligible
Chinook	Negligible	Negligible
Steelhead	Negligible	Negligible
Dolly Varden	Moderate	Moderate

Management concern for:	
Large wood	Moderate
Sediment retention	High
Stream bank stability	High
Sideslope sensitivity	N/A
Flood plain protection need	High
Culvert fish passage	N/A

Riparian Management: Sediment deposition is a dominant process in estuarine deltas, therefore, sediment retention in ESM channels is high. These channels are very sensitive to intrusion of fine sediments into spawning beds. The effect of cumulative sediment impacts from upstream watershed disturbance is a major management concern.

Erosion control (BMPs 13.11), control of road drainage (BMP 14.9), and road maintenance (BMPs 14.20) are mitigation measures that should be emphasized in areas near these streams.

Stream bank sensitivity is high due to high amounts of fine unconsolidated alluvium in ESM stream banks. Bank erosion can be significant source of sediment in these

channels. Channel protection (BMP 13.16) and bridge design and implementation (BMP 14.17) should be emphasized.

Protection of estuarine wetland and flood plain habitat (BMPs 12.4, 12.6) is an important management consideration for ESM channels and associated riparian areas. These intertidal wetlands provide extremely important habitat for waterfowl, furbearers and a wide variety of aquatic species.

Stream Class: These are classified as Stream **Class I** streams. A minimum 100 foot timber harvest buffer is required along both banks of these streams (Tongass Timber Reform Act, 1991). Control of in-channel operations is an important riparian management concern for these streams (BMP 14.14).

Riparian Management Opportunities:

Sport Fish Potential.....High

Enhancement Opportunities....Large wood placement

ESM channel segments have excellent sport fishing opportunities. Foot access is good from the beach and also from small boats at high tide. Primary species of interest are Dolly Varden char, coho and pink salmon.

Large wood fish enhancement projects may be options in ESM and ESL channels. These structures can be used to improve cover and available pool habitat for adult spawners and rearing juvenile fish. Structures must be designed and anchored to withstand extreme tides.

ESL - Large Estuarine Channel (formerly ES4)



Channel Characteristics

Stream Class:	I
Bankfull width:	> 20 m (66 ft)
Stream gradient:	< 1 %
Incision depth:	< 2 m
Stream bank composition:	alluvium
Sideslope length and angle:	not significant
Channel pattern:	single to multiple, sinuous, may bifurcate near saltwater terminus
Basin area:	>40 km ² (15mi ²)

Aquatic Habitat Capability

Large wood	1200 ft ³ /1000 linear ft
Available Spawning area (ASA)	Average = 22% for 11 sites
Available Rearing area (ARA)	Average = 7% for 10 sites

Indicator Species Ratings		
MIS	ASA	ARA
Coho	High	Low
Pink	High	High
Chum	High	High
Sockeye	Negligible	Negligible
Chinook	Negligible	Negligible
Steelhead	Negligible	Negligible
Dolly Varden	Moderate	Moderate

Management Considerations:

See **ESM**, as the management considerations are the same.